

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

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| In the Matter of |) | |
| |) | |
| Expanding Flexible Use in Mid-Band Spectrum |) | GN Docket No. 17-183 |
| Between 3.7 and 24 GHz |) | |

TO: The Commission

REPLY COMMENTS OF PACIFICORP

PacifiCorp, through its undersigned counsel, submits these Reply Comments in response to the above-referenced *Notice of Inquiry*, FCC 17-104 (“*NOI*”) on expanding use of various spectrum bands between 3.7 and 24 GHz. PacifiCorp has serious concerns regarding the potential for harmful interference to its private operational fixed microwave facilities in the 6 GHz Fixed Service bands, used in the operation and control of the power grid in the Pacific Northwest, if other licensed services or unlicensed devices are authorized in these bands. Other commenters are in agreement with PacifiCorp’s concerns.

I. Background

PacifiCorp is an electric utility that provides electric service to approximately 1.6 million retail customers in service territories covering about 136,000 square miles in portions of six western states: Utah, Oregon, Wyoming, Washington, Idaho and California. The combined service territory’s diverse regional economy ranges from rural agricultural and mining areas to urbanized manufacturing and government service centers. PacifiCorp has more than 8,300 megawatts of generation capacity from coal, hydro, renewable wind power, gas-fired combustion

turbines and geothermal, and delivers electricity through approximately 57,000 miles of distribution lines and 15,000 miles of transmission lines. PacifiCorp operates the largest non-governmental bulk power system west of the Mississippi River. PacifiCorp operates as Pacific Power in Oregon, Washington, and California, and as Rocky Mountain Power in Utah, Idaho and Wyoming. The electricity provided through PacifiCorp's utility infrastructure is vital to all aspects of daily life throughout a significant portion of the Pacific Northwest.

II. PacifiCorp's Microwave System Supports Critical Operations and Public Safety

PacifiCorp operates an extensive private microwave system throughout its service territory. The microwave system, which operates in several point-to-point microwave bands, includes about 476 licensed microwave transmitters in the 6 GHz band. Because of the vast distances between PacifiCorp's facilities and the irregular terrain in this area, typical path lengths at 6 GHz are 35-45 miles. However, PacifiCorp also has some 6 GHz paths in the 60-70-mile range in certain areas with generally dry climate (*e.g.*, in Utah). PacifiCorp also has much shorter paths in the 11 GHz and 18 GHz bands, with paths at 18 GHz generally less than 10 miles in length because of significant rain attenuation.

PacifiCorp designs its microwave facilities for very high availability (*e.g.*, mere seconds of outage per year) due to the criticality of the communications carried on this network. PacifiCorp deploys microwave facilities in very rural areas where other communications facilities are not available and/or where it would be prohibitively expensive, problematic, or impossible to install fiber optics. Also, in many instances, PacifiCorp would have to renegotiate its right-of-way agreements to allow the installation of fiber along existing utility transmission corridors. Microwave allows for highly reliable communications pathways without these major impediments.

PacifiCorp's microwave facilities support a variety of utility applications, including protective relaying, voice, corporate data, and supervisory control and data acquisition ("SCADA"). Through protective relaying, PacifiCorp can continuously monitor power flows along its high voltage transmission lines, and the system can automatically interrupt power flows within milliseconds after detecting a change in operating parameters that could signify a fault on the electric system.¹ Absent such real-time and instantaneous action, a fault condition could allow the damage to quickly cascade beyond the immediate area of the fault, causing outages and potentially millions of dollars of damage to the power grid and/or threaten other property or persons on or near the transmission system.

An unplanned disruption to or outage of the protective relaying system itself could also result in activation of a remedial action scheme ("RAS") to isolate system components, and/or force changes in demand, generation, or system configuration to maintain system stability, acceptable voltage or power flows.² Because electric current flows at nearly the speed of light in a vacuum, it is absolutely critical that protective relaying systems are always ready to take

¹ The National Institute of Standards and Technology ("NIST") has recommended latency of less than 4 milliseconds for protective relaying systems to ensure safety and reliability of the electric transmission grid. "Guidelines for Smart Grid Cybersecurity," Volume 1: Smart Grid Cybersecurity Strategy, Architecture, and High-Level Requirements, NISTIR 7628 (September 2014), U.S. Department of Commerce, at 155. Available at: <http://nvlpubs.nist.gov/nistpubs/ir/2014/NIST.IR.7628r1.pdf> (last accessed March 24, 2017).

² On June 23, 2016, the Federal Energy Regulatory Commission ("FERC") approved a revision to the definition of "Remedial Action Scheme" to define it as "[a] scheme designed to detect predetermined System conditions and automatically take corrective actions that may include, but are not limited to, adjusting or tripping generation (MW and Mvar), tripping load, or reconfiguring a System(s)." FERC notes that this definition is intended to help meet industry standards for reliability of the interconnected power grid, and maintain stability of the bulk electric system in the United States. See also "Remedial Action Schemes Reliability Standard," *Notice of Proposed Rulemaking*, FERC Docket No. RM16-20-000, 82 Fed.Reg. 9702, 9703 (February 8, 2017).

decisive action within milliseconds of detecting a fault and, conversely, that they are not tripped by conditions that are perceived as faults.³ With the high voltages and inherent speed of electricity in the bulk power supply system, disruptions to a microwave system used for protective relaying could have devastating consequences to the grid and to consumers throughout a very broad region of the country.

Private microwave is the preferred medium for communications into and out of electric substations, which are key components on the electric grid. For example, in the event of a widespread weather-related outage of the electric system, initial efforts are focused on evaluating and restoring operations at the substations before work can proceed to the distribution lines to individual homes and businesses. Thus, it is critical for the utility to be able to closely monitor the security and operation of its substations and to be able to remotely control and reconfigure components to the extent possible. Microwave paths are typically looped through the substations to provide redundancy for reliability and infrastructure protection.

III. Mobile Operations Are Incompatible with Fixed Microwave

PacifiCorp shares the concerns of other comments about introducing mobile operations in Fixed Service bands such as the 5.925 – 6.425 GHz and 6.525 – 7.125 GHz bands (collectively

³ The Northeast Blackout of 2003, during which 55 million people in eight states and portions of Canada lost power for up to several days, illustrates the catastrophic consequences of a cascading power outage that can be triggered by a single fault; in this case, a sagging electric transmission line in Ohio that touched overgrown trees. “13 Years After: The Northeast Blackout of 2003 Changed Grid Industry, Still Causes Fear for Future,” Electric Light & Power, August 23, 2016; available at <http://www.elp.com/Electric-Light-Power-Newsletter/articles/2016/08/13-years-after-the-northeast-black-of-2003-changed-grid-industry-still-causes-fear-for-future.html> (last visited March 24, 2017).

“6 GHz”).⁴ Fundamentally, mobile transmitters cannot protect fixed microwave receive locations. Transmitters can be detected from the mobile device when a signal is detected, but there is no way for that mobile device to know what microwave receive antennas it might be interfering with. Microwave receive antennas do not send out signals, and the mobile device will find it difficult to detect the transmitting signal up to 50 miles away because it could be blocked by mountains, trees, or other vegetation. Nevertheless, the microwave receiver could still be interfered with by the mobile transmitter.

Fixed microwave paths can be engineered for high reliability because of prior frequency coordination and licensing, which ensures compatibility from initial system design and the ability to more promptly identify the potential source of interference once it is detected. Neither of these measures is possible in the case of mobile transmitters, whether licensed or unlicensed.

Even if mobile devices were equipped with dynamic frequency selection capability based on sensing, they could not assure non-interference to fixed microwave systems, nor would Fixed System licensees have ability to identify and mitigate actual interference caused by mobile devices. Point-to-point microwave receive antennas are generally located high above ground, and aimed at the corresponding transmit antenna many miles distant. Mobile users can be at any height below or above the microwave path, at any azimuth from the microwave path, and can even be located behind objects that could significantly attenuate signals from the corresponding microwave transmitter. Just because a mobile device cannot detect the microwave transmission does not mean the microwave receiver will not detect a signal from the mobile device. Thus, it is

⁴ Comments of Duke Energy at 3-4; Lower Colorado River Authority at 4-5; Utilities Technology Council and Edison Electric Institute at 7-8; Southern Company Services, Inc. at 4-6; Tucson Electric Power Company at 5-7.

too risky to authorize mobile operations, whether licensed or unlicensed, and even with a frequency-sensing capability, in bands that are used for point-to-point microwave.⁵

Several proponents of allowing unlicensed devices in the 6 GHz band claim that there is little likelihood of interference because Wi-Fi devices operate at low power and generally indoors, while point-to-point microwave systems operate at high power, outdoors, and with highly directional antennas.⁶ However, point-to-point microwave systems do not operate at “high power,” and due to the path lengths typically involved, the received signal levels can be very low. In addition, it is not clear how it could be guaranteed that an unlicensed device would be operated indoors, or that any attenuation from indoor use would necessarily prevent the device from interfering with microwave communications. The Fixed Wireless Communications Coalition (“FWCC”) has presented a technical analysis of how a very low power unlicensed device (10 milliwatts) could interfere with fixed microwave systems at distances up to several miles in front of the microwave receive antenna, and how a device operating at power levels allowed for Wi-Fi could cause interference up to 110 miles away.⁷

It is difficult enough to maintain PacifiCorp’s expansive communications facilities to support utility operations, but interference from mobile or other devices would probably double the time required for electric service restoration. During and following weather-related outages

⁵ PacifiCorp raised similar objections to the authorization of mobile earth terminals in the 6 GHz band that will allegedly use a proprietary centralized coordination database to instruct mobile devices to avoid interference to fixed microwave systems. See “Ex Parte Comments of PacifiCorp in Support of Application for Review,” of *Order and Authorization, In the Matter of Higher Ground, LLC, Application for Blanket License to Operate C-Band Mobile Earth Terminals*, IBFS File No. SES-LIC-20150616-0357, 32 FCC Rcd 728 (IB/WCB/OET 2017).

⁶ All Points Broadband, *et al.*, at 11; Dynamic Spectrum Alliance at 14-15; and Broadcom Ltd. at 11.

⁷ FWCC at 9-11.

PacifiCorp relies on its private communications facilities to assess damage and, to the extent possible, remotely reconfigure electric operations. If PacifiCorp loses communications with substation equipment or other system components, field crews must be dispatched to make an on-site inspection. This adds time and expense to the restoration effort, to the ultimate detriment of consumers and public safety.

IV. Incumbent Fixed Service Licensees Should Not Be Relocated From 6 GHz

Because of the transition of microwave systems from the 2 GHz Fixed Service bands occasioned by the Emerging Technologies proceeding, ET Docket No. 92-9,⁸ the 6 GHz band became the preferred replacement band for many frequency paths that had been licensed at 2 GHz. However, relocating paths from 6 GHz to the next higher microwave bands would be even more problematic because of the shorter path lengths that can be accommodated in the higher bands and because of the increased number of paths that are at 6 GHz due to their previous transition from the 2 GHz band.⁹

PacifiCorp's experience with the 2 GHz transition was mixed. Some new entrant licensees simply elected to run-out the clock on the voluntary and mandatory negotiation periods, and essentially forced PacifiCorp to vacate its 2 GHz paths at PacifiCorp's own expense. On the other hand, PacifiCorp was also able to structure some transactions with new entrants that allowed PacifiCorp to upgrade from analog to digital microwave by agreeing to pay the cost differential between an analog and a digital replacement. This was a win-win for the new entrant and for PacifiCorp. However, a transition from 6 GHz digital microwave to digital microwave in

⁸ *Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, ET Docket No. 92-9, Second Report and Order, 8 FCC Rcd 6495 (1993).

⁹ Comments of Fixed Wireless Communications Coalition at 13; Tucson Electric Power at 9-10.

a higher band would not provide any additional benefit or opportunities for PacifiCorp, and would as explained below, result in a net decrease in system reliability.

If these paths were to be relocated to the next higher Fixed Service bands (*e.g.*, 11 or 18 GHz), many of the paths would need additional infrastructure for intermediate relays. Because of extremely hilly and rugged terrain in the Pacific Northwest, there are relatively few hilltops that are both accessible and equipped with commercial power for the operation of radio transmitting facilities. The sites that are available are used by many licensees, and microwave paths tend to follow the same communications corridors between these hilltop facilities. As a result, it is very difficult to coordinate new paths in these areas. Even if additional sites could be found, the addition of extra paths in the network would reduce overall reliability of the system by creating additional points of failure.

If anything, PacifiCorp sees a need for more 6 GHz bandwidth along existing paths to support utility operations; for example, the need for more 30-40 MHz bandwidth channels.¹⁰ The Pacific Northwest is experiencing an increase in population, even in what had been small, rural communities. At the other end of the power delivery system, PacifiCorp must interconnect with new solar energy plants and wind farms to meet demand for more “green energy.” With a growing population and increasing number of power generators comes the need for more communications capacity to support electric operations. PacifiCorp submits that this demand for microwave capacity could be met, at least in part, if the Commission could work with the National Telecommunications and Information Administration (“NTIA”) to allow non-federal

¹⁰ Comments of Ericsson at 10 (additional spectrum will be needed for high capacity point-to-point links).

public safety entities and utilities to license point-to-point systems in the Federal 7 GHz band, which is allocated and used for very compatible purposes.¹¹

PacifiCorp's need for bandwidth is also being driven by requirements for greater security at electric substations and other key facilities. Federal and state regulatory agencies are calling for greater security of utility infrastructure, including more extensive video surveillance around electric substations, in response to well-publicized instances of sabotage to the electric grid. The Commission would be working at cross-purposes with infrastructure protection if it were to further deplete the amount, or quality, of Fixed Service spectrum that PacifiCorp and other utilities may use for these purposes.

Finally, PacifiCorp does not believe an "incentive auction" model would incentivize many Fixed Service licensees to relocate. PacifiCorp, and other Critical Infrastructure or public safety licensees, use these systems for highly reliable communications necessary to support essential public services. None of PacifiCorp's microwave facilities were deployed for financial gain, so there would be no benefit to PacifiCorp in putting this spectrum up for auction. These communications systems are a necessary "tool" in the operation of PacifiCorp's power system, and could not be easily replaced.

¹¹ See also Comments of T-Mobile USA, Inc. at 21 (the 7.125-8.400 GHz federal band should be made available for federal/non-federal sharing). PacifiCorp, and many other private-sector utilities, interconnect directly or indirectly with power transmission systems owned and operated by federal Power Marketing Administrations, such as the Bonneville Power Administration and the Western Area Power Administration. Private-sector utilities also intercommunicate with these agencies, in many cases with point-to-point microwave systems that "meet in the air;" *i.e.*, one-half of the frequency pair is licensed to the private-sector utility on FCC-licensed microwave frequencies, and the return path is authorized to the Federal entity by NTIA on frequencies from the Federal allocation. Allowing private-sector utilities to be licensed in the same frequency bands as these Federal entities would facilitate coordination, authorization and intercommunication.

WHEREFORE, THE PREMISES CONSIDERED, PacifiCorp respectfully requests that the Commission take these views into consideration in connection with the above-referenced matter.

Respectfully submitted,

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